

Attorney Docket No. 24061.37
Customer No. 42717

REMARKS

Claims 1 and 14-18 have been canceled, and Claims 2-4, 6-13 and 19 have been amended. Claims 2-13 and 19-25 are present in the application. In view of the foregoing amendments, and the remarks that follow, Applicants respectfully request reconsideration.

Claims 14-18

Claims 14-18 were withdrawn from consideration pursuant to a restriction requirement, and have been canceled. Applicants reserve the right to file a divisional application presenting the subject matter of Claims 14-18 for examination.

Second Paragraph of 35 U.S.C. §112

Claims 7, 8, and 19-25 were rejected under the second paragraph of 35 U.S.C. 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These rejections are based on language in Claims 7, 8 and 19. The foregoing amendments to Claims 7, 8 and 19 are intended to cure each ground of rejection.

In particular, Claim 7 has been amended to recite that "the second electrode is within a perimeter of the first electrode when viewed in a direction perpendicular to the first and second electrodes." Claim 8 has been amended in a similar manner. Claim 19 has been amended to eliminate the phrase "by a third electrode".

These amendments to Claims 7, 8 and 19 are implemented for the purpose of improving the form of these claims, and do not change the intended scope of these claims. It is believed that Claims 7-8 and 19-25 are now in proper form, and notice to that effect is respectfully requested.

Independent Claim 4

Claim 4 originally depended from Claim 1. The foregoing amendments place Claim 4 in independent form, by adding to Claim 4 the limitations of Claim 1. Also, a colon has been removed from Claim 4, to correct an inadvertent typographical error. These amendments merely convert Claim 4 into independent form, without making any change to the scope of Claim 4.

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Claim 4 was rejected under 35 U.S.C. §103 as obvious over Hoshi U.S. Patent No. 5,903,023. This ground of rejection is respectively traversed. In this regard, the PTO recognizes in MPEP § 2142 that:

The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness...

Applicants respectively submit that Hoshi fails to establish a *prima facie* case of obviousness under §103 with respect to Claim 4, for the mutually exclusive reasons that are discussed below.

HOSHI DOES NOT TEACH THE CLAIMED SUBJECT MATTER

The provisions of MPEP §2142 specify with respect to §103 that:

To establish a *prima facie* case of obviousness... the prior art reference (or references when combined) must teach or suggest all the claim limitations. (Emphasis added)

Thus, when evaluating a claim for obviousness, the reference must teach or suggest all limitations of the claim. Claim 4 includes a recitation that:

the first electrode and the first interconnect are connected by a first via; the second electrode and the second interconnect are connected by a second via; and the third electrode and the first interconnect are connected by a third via.

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The Office Action states (page 4, lines 4-5) that: "With respect to claim 4, the vertical portions connecting horizontal layers are identified as vias." This argument is respectfully traversed as to the vertical portion that is shown at 1a in Figure 1C of Hoshi. More specifically, as to vertical portions, Hoshi uses the term "contact hole" to refer to certain structure in Figures 1B and 1C that is similar to a via. (Fig. 1C is the cover figure cited by the Examiner). In particular, Hoshi identified all contact holes in Figs. 1B and 1C with the reference numerals 5a to 5g. However, the vertical portion at 1a of Hoshi, which extends from a top electrode to a bottom electrode, is not identified by Hoshi as one of the contact holes or vias 5a to 5g. In fact, as discussed below, Hoshi teaches that the vertical portion at 1a should not be a via.

The structure of a via is commonly known and well defined in integrated circuit technologies. The following are two definitions respectively obtained from the Internet, and from a semiconductor textbook.

- 1.) The Semiconductor Glossary Web site at <http://semiconductorglossary.com> defines a via as a "hole etched in the interlayer dielectric which is then filled with metal, usually tungsten, to provide vertical connection between stacked up interconnect metal lines." (Applicants are enclosing a courtesy copy of a printout of the page from this Web that sets forth this definition).
- 2.) The semiconductor processing book "Silicon Processing for the VLSI Era" by Professor Stanley Wolf defines "vias" in line 6 on page 189, stating that: "Openings in the intermetal dielectric layers are known as vias". (Applicants are enclosing a courtesy copy of an excerpt from this book, including two title pages and page 189).

The above definitions of "via" are both directed to an opening in a dielectric layer, and are both consistent with use of the term "via" in the present application. In contrast, as to the vertical portion that extends at 1a between top and bottom electrodes in Hoshi, Hoshi explicitly describes this structure and how it is formed, and makes it clear that this structure is intentionally not a via.

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First, the vertical portion at 1a is an integral part of the material of the top electrode, and is not the same as a via. With reference to Figures 6A to 6J, Hoshi describes how this structure is formed (col. 6, line 65 to col. 7, line 10), as follows:

Next, a metal electrode layer 17 is formed by oblique sputtering where the sputtering angles $\theta=10$ degrees to 30 degrees and $\varphi=270$ degrees. ... The third metal electrode layer 17 overlaps with most of the surface of the second dielectric layer 16 and with the exposed surface of the first metal electrode layer 11, The third metal electrode layer 17 is therefore in contact with the first metal electrode layer 11, (Emphasis added)

The vertical portion of Hoshi's top electrode layer 17 overlaps with the exposed surface of the bottom electrode layer 11, and is therefore in contact with the bottom electrode layer 11. This vertical portion is distinctly different from a via structure, both in terms of its structure, and how it is fabricated.

Thus, the vertical portion at 1a in Hoshi and "the third via" in the Applicants' Claim 4 are distinctly different in terms of structure and formation. Therefore, since Hoshi does not teach that "the third electrode and the first interconnect are connected by a third via" (as recited in Applicants' Claim 4), Hoshi does not disclose all limitations of Claim 4, and the requirement of MPEP §2142 is therefore not met. For this reason alone, it is respectfully submitted that the Examiner's burden of factually supporting a *prima facie* case of obviousness has not been met, and that the rejection under 35 U.S.C. §103 should be withdrawn.

PTO CANNOT ESTABLISH OBVIOUSNESS WITH ART THAT TEACHES AWAY

Hoshi teaches away from Claim 4. For example, the Hoshi patent describes (from col. 6, line 65 to col. 7, line 10) how the vertical portion at 1a is formed by oblique sputtering:

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Next, a metal electrode layer 17 is formed by oblique sputtering where the sputtering angles $\theta=10$ degrees to 30 degrees and $\phi=270$ degrees. In FIG. 6G, a sputtering incident direction is indicated by arrows I₄. This third metal electrode layer 17 is formed in the aperture 13a. The third metal electrode layer 17 overlaps with most of the surface of the second dielectric layer 16 and with the exposed surface of the first metal electrode layer 11, but does not overlap with the exposed surfaces of the lower metal electrode layer 12 and the second metal electrode layer 15. The third metal electrode layer 17 is therefore in contact with the first metal electrode layer 11, but is electrically isolated from the lower metal electrode layer 12. It will be assumed that this third metal electrode layer 17 is of the same metal as the second metal electrode 15 and has the same thickness. It should be noted that the metal electrode layer 17a is also formed on the surface of the dielectric layer 16a.

The Hoshi patent also describes various oblique sputtering devices to implement the above-described process (col. 3, line 65 to col. 5, line 32). Further, the Hoshi patent describes forming a mask layer having an inverted taper shape (col. 5, line 64 to col. 6, line 8). By integrating all these teachings together, Hoshi forms the vertical portion at 1a without the need for an etching step of the type that is normally part of the process to form a via. The Hoshi patent expressly emphasizes this difference (at col. 7, lines 52-56), by stating that:

It is therefore unnecessary to perform the steps of sputtering, patterning, etching, and resist removing to form each layer as when the etching method is used, hence the process is simplified, and the capacitor can be formed efficiently.

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The Hoshi patent further states in the Summary of the Invention section (col. 1, lines 38-43) that this is one object of the invention, and in particular that:

It is an object of the present invention to provide ... a method of efficiently fabricating such a semiconductor device, and to provide a sputtering apparatus suitable for this fabrication method.

Clearly, Hoshi teaches away from use of a via structure such as that recited in Applicants' Claim 4. Since it is well recognized that teaching away from the claimed invention is a per se demonstration of lack of prima facie obviousness, it is respectfully submitted that the Examiner has not borne the burden of factually supporting a prima facie case of obviousness. Thus, for this reason alone, the rejection under 35 U.S.C. §103 should be withdrawn.

HOSHI CANNOT BE PROPERLY MODIFIED SINCE THE INTENDED PURPOSE IS DESTROYED

It is respectfully submitted that the Hoshi device cannot properly be modified in the manner proposed in the Office Action (so as to replace the vertical portion 1a with a via), for the following reasons. With respect to the analysis of obviousness under §103, the provisions of MPEP §2143.01 specify that, where a modification to a reference is proposed:

THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE

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If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

In the present situation, Hoshi teaches (at col. 7, lines 2-10) a structural arrangement in which:

The third metal electrode layer 17 overlaps... with the exposed surface of the first metal electrode layer 11.... The third metal electrode layer 17 is therefore in contact with the first metal electrode layer 11....

Hoshi teaches that this approach achieves benefits, including that "the process is simplified, and the capacitor can be formed efficiently" (col. 7, lines 55-56). This meets one of the objects of the Hoshi invention, in that Hoshi states (at col. 1, lines 38-43) that:

It is an object of the present invention ..., to provide a method of efficiently fabricating such a semiconductor device, and to provide a sputtering apparatus suitable for this fabrication method.

The Office Action proposes modifying the Hoshi device to substitute a via for the the vertical portion at 1a that connects the top and bottom electrodes. However, this change would destroy an intended purpose of the Hoshi invention. Accordingly, one of ordinary skill in the art would not have been motivated to make the proposed modification. Thus, for this reason alone, the Examiner's burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection under 35 U.S.C. §103 should be withdrawn.

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THERE IS NO MOTIVATION TO MODIFY HOSHI

There is yet another reason why Hoshi cannot be modified under §103 to reject Claim 10. In this regard, MPEP §2142 provides that:

To reach a proper determination under §103, the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. . . Knowledge of applicant's disclosure must be put aside in reaching this determination, . . . impermissible hindsight must be avoided, and the legal conclusion must be reached on the basis of the facts gleaned from the prior art.

The MPEP further provides at § 2143.01 that:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. . . Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so". (Emphasis in original).

In the present situation, the prior art does not provide motivation to make the proposed modification to Hoshi (by replacing the vertical portion at 1a with a via). More specifically, and as discussed above, Hoshi teaches (in col. 1, lines 38-43) that it is an object of his invention "to provide a method of efficiently fabricating such a semiconductor device, and to provide a sputtering apparatus suitable for this fabrication method". Moreover, Hoshi teaches that this object is met by providing a structure that connects two electrodes using the vertical portion at 1a rather than a via, and by providing a corresponding method to make this structure, thereby

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achieving various benefits, including the fact that "the process is simplified, and the capacitor can be formed efficiently" (col. 7, lines 55-56).

The proposed modification to Hoshi's device (to substitute a via for the vertical portion at 1a) would result in a device that did not meet Hoshi's stated objects and that did not achieve the benefits discussed in Hoshi. Thus, a person of ordinary skill in the art would not be motivated to make such modification. Accordingly, for this reason alone, the Examiner's burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection under 35 U.S.C. §103 should be withdrawn.

In view of the various different reasons discussed above, it is respectfully submitted that Claim 4 is not rendered obvious under §103 by Hoshi. Claim 4 is therefore believed to be allowable, and notice to that effect is respectfully requested.

Independent Claim 19

The Office Action rejected Independent Claim 19 under 35 USC §103 as obvious in view of the Hoshi patent. This ground of rejection is respectfully traversed. Claim 19 recites:

a first interconnect located over the dielectric layer, coupled to the first electrode by a first via, and coupled to the third electrode by a second via; and

a second interconnect located over the dielectric layer, coupled to the second electrode by a third via, and coupled to the transistor contact by a fourth via.

Based on the way that the Examiner is reading Claim 19 onto Figure 1C of Hoshi, the Examiner is asserting that the "third electrode" in Claim 19 corresponds to the top electrode in Figure 1C of Hoshi. However, Claim 19 specifies that the third electrode is coupled to an interconnect by "a second via". In contrast, the only electrical connection to the top electrode in Figure 1C of Hoshi is the vertical portion at 1a, and as discussed above in association with Claim 4, Hoshi has

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intentionally configured the vertical portion at 1a so that it is not a via. For reasons discussed earlier, it would not be obvious under §103 to replace the vertical portion at 1a with a via. Moreover, the vertical portion at 1a couples the top electrode to the bottom electrode, rather than to an interconnect. Accordingly, it is respectfully submitted that the subject matter of Claim 19 is not obvious under §103 in view of Hoshi. Claim 19 is therefore believed to be allowable, and notice to that effect is respectfully requested.

Dependent Claims

Claims 2, 3, and 5-13 and Claims 20-25 respectively depend from Claim 4 and Claim 19, and are also believed to be distinct from the art of record, for example for the same reasons discussed above with respect to Claims 4 and 19.

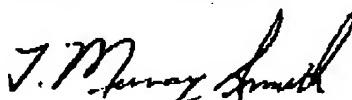
Conclusion

Based on the foregoing, it is respectfully submitted that all of the pending claims are fully allowable, and favorable reconsideration of this application is therefore respectfully requested. If the Examiner believes that examination of the present application may be advanced in any way by a telephone conference, the Examiner is invited to telephone the undersigned attorney at 972-739-8647.

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Although Applicants believe that no fees are due in association with the filing of this Amendment, the Commissioner is hereby authorized to charge any additional fee required by this paper, or to credit any overpayment, to Deposit Account No. 08-1394 of Haynes and Boone LLP.

Respectfully submitted,



T. Murray Smith
Registration No. 30,222
(972) 739-8647

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HAYNES AND BOONE, LLP
901 Main Street, Suite 3100
Dallas, Texas 75202 3789
Telephone: (972) 739-8647
Facsimile: (214) 200-0853
File: 24061.37

Enclosures: Copy of Web Page from www.semiconductorglossary.com (1 sheet)
Copy of Excerpt from "Silicon Processing for the VLSI Era" (3 sheets)

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